

# Waste-Oil Forge and Foundry

by [notjustsomeone](#) on June 10, 2008

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## Intro: Waste-Oil Forge and Foundry

This demonstrates how I made a basic setup for casting, and can also to some extent be used for blacksmithing.

Let me state a disclaimer that I know almost nothing about blacksmithing and most of my knowledge thus far is from research and not experience. The processes and materials presented and resulting from the information I am sharing are potentially lethal. Please consider this as a primer to get you interested and demonstrate how simple it is to make the necessary items for forging and casting. Do, however, search elsewhere for more information before undertaking any projects.

some good places to start:

<http://64.176.180.203/tutorials.htm>  
<http://www.anvilfire.com/iForge/>  
<http://www.navaching.com/forge/forgeindex.html>  
<http://www.backyardmetalcasting.com/index.html>

other instructables:

<http://www.instructables.com/id/Waste-Oil-Furnace-For-Melting-Metal/>  
<http://www.instructables.com/id/How-to-make-a-forge/>  
[http://www.instructables.com/id/Make-a-Small-Blacksmith\\_s-Forge/](http://www.instructables.com/id/Make-a-Small-Blacksmith_s-Forge/)  
<http://www.instructables.com/id/Make-a-small%2c-practical-forge/>  
<http://www.instructables.com/id/Coffe-Can-Aluminum-Foundry/>  
<http://www.instructables.com/id/Pizza-Sauce-Can-Furnace/>

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GODDARD.



### step 1: Waste Oil Burner

For the burner you need 1 and 1/4 inch pipe fittings: two T's, two full-thread nipples, one 3" long nipple, two caps, a reducer that goes down to 3/4" and a 3 inch long 3/4" nipple.

Fit everything together as shown with a couple pipe wrenches except the top cap. Drill a hole for the oil line. Test it to make sure it's working the way you want it to. Then encase it in fire clay. (see next step)

For the oil line I've just used some 1/4 brass tubing I had but steel brake line would be better. I fitted this to a valve and the valve to a tube going to my oil container. So far my container is just a can with a copper coupling for a hose in the bottom.

For the forced air I took a small vacuum and duct-taped a tube to the air exhaust, the tube is about 20" long. Then I use a pipe clamp to secure it to the burner. Eventually this will be replaced by a small squirrel-cage type blower.

To run the burner I first start a wood or sometimes charcoal fire in it. Just get some small chunks of wood and fill up the main section of the burner. Once it's burning well put the cap on and connect the blower, turn it on as low as you can. Turn the oil on to a very slow drip, it'll probably get really smokey for a bit. If the flames go out back down the air input or throw in a couple more pieces of wood. As the burner heats up try turning the blower on higher, work gradually until there is a steady bright yellow flame coming out of the blower. As the air is turned up you'll have to open the oil valve more. On a full blow oil will have to be streamed in steadily and excess will fill the bottom and leak out the air input. Just catch this with a cup and pour it back into the oil container.



**Image Notes**

1. bottom cap you can't see
2. full-thread nipple
3. full-thread nipple
4. reducer
5. top cap
6. walnut
7. small cup to catch oil
8. oil line
9. used motor oil
10. fire-clay bricks
11. furnace
12. 3 inch long nipple
13. 1 and 1/4 inch T intersection



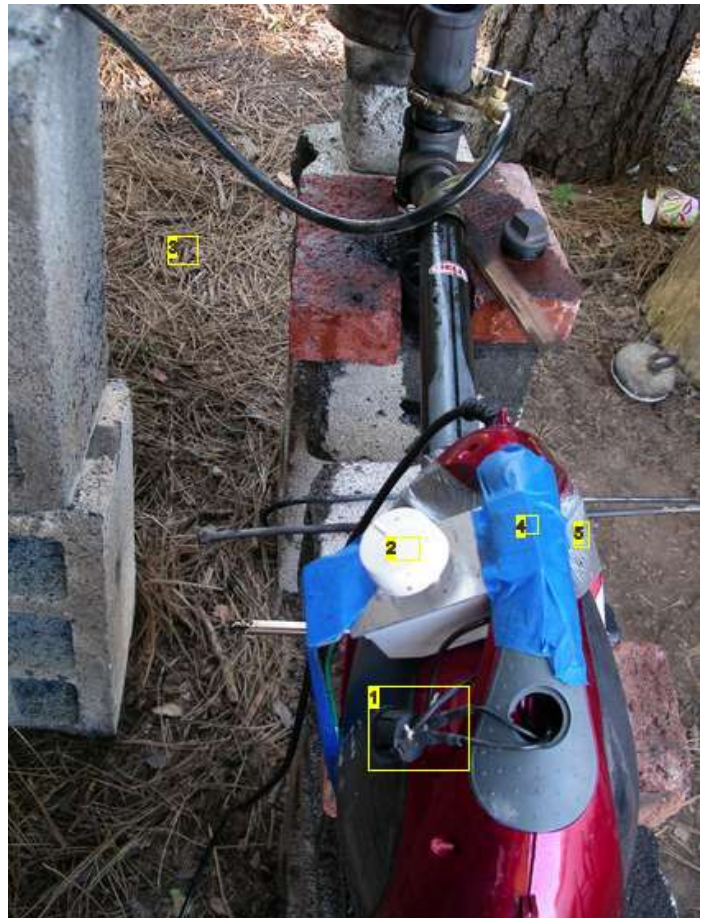
**Image Notes**

1. oil can
2. gravity-fed oil line, that's why it's up on cinderblocks
3. valve, it's important



**Image Notes**

1. Caution, this is so ghetto and can sound like a jet engine, you might scare the neighbors
2. My first furnace, believe it or not I could melt iron in it, though I found out by accident.



**Image Notes**

1. Dimmer switch wired directly to the on/off switch so when I'm done with it it will still work as is.....maybe.



2. dimmer switch
3. use extreme caution when working in flammable environments
4. masking tape
5. duct tape

## step 2: Furnace

The Furnace is really simple.

The bulk of this is fire clay. Other than that you just need something to contain it in and another can to leave space for the heating chamber. I started out small with a coffee can and then went to a larger one made in a big popcorn tin.

Next you need fire clay. I don't live anywhere near a foundry or within an easy distance to get fire clay so I made my own. for this you need four things; portland cement, perlite, silica sand, and bentonite.

Just about any lumberyard or hardware store carries portland cement. Don't confuse this with ready-mix or even masonry, get the stuff that says PORTLAND CEMENT really big on the outside of the package.

Perlite is the white stuff in potting soil. It comes in a bag by itself, it can usually be found at walmart but can also be found at nurseries, lawn&garden places and hardware stores.

Pure silica sand is best but any fine sand will do. probably the easiest to get is the bags of "play sand" you can find at walmart or building centers like home depot or lowes. A lot of tractor supply stores in the midwest carry it during the summer. If you can't find it or just don't want to pay for sand you could just get some from a dry riverbed and sift it (don't take sand from beaches).

Bentonite is what most cheap cat litter is made of. Just look at the label, it should say ingredients: bentonite, make sure it's not mixed with other things like fragrance. If you get cat litter you'll probably have to find a way to grind and sift it. This takes a lot of time and effort. If you don't want to go through all the trouble just find somewhere online to buy it.

To make the masonry I go with a 1:1:1:1 ratio.

mix one part sand, bentonite, and perlite together, add a little water and mix thoroughly.

let it sit for 30 minutes.

add a little more water and mix again, let sit for 45 minutes.

add one part portland cement and enough water so everything is moist and sticks together, but not too much so it's runny. You want it just wet enough to cake easily in your hand and not crumble when you squeeze it.

First fill the bottom to the thickness you want and pack it down. Then put the center can in and ram fire clay down around it. Once the clay dries a hole is drilled through the wall just above the bottom of the heating chamber and to one side so the heat from the burner tends to spin in the chamber. Then a lid will need to be made. Just use another tin about the same size in diameter, though it only needs to be about 3 inches thick and leave a 2 or 3 inch hole in the center. Once it is set remove the lid from the tin.



### Image Notes

1. Eventually this can will melt, but until then I'm just going to leave it in there.

## step 3: Flask and Casting Bench

The casting bench is really just a box with legs that brings it up to a convenient working height. On the inside of the box 2 or 3 inches from the top make horizontal cleats on the front and back. Cut two pieces of wood to fit across these. The next thing needed is two boards big enough to cover the flask.

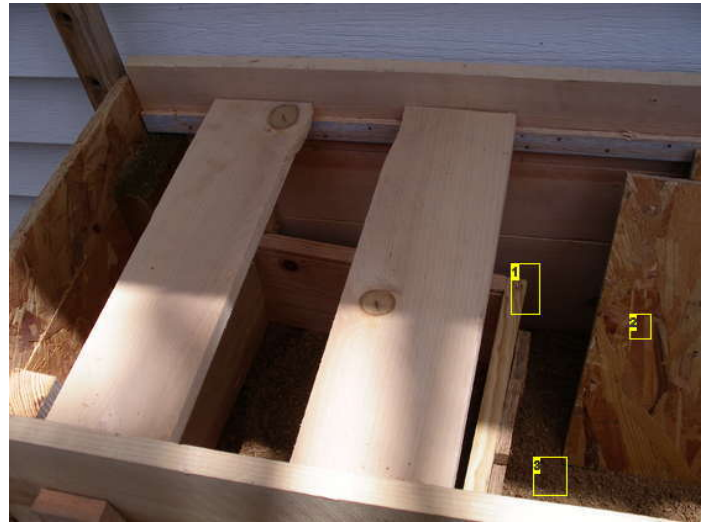
The flask itself is simpler than people make it out to be. Just make a box without a top or bottom and cut it in half. Then use some thin material to make an alignment piece on two sides of the flask. If you consistently have problems with the sand falling out, attach a small strip of wood around the edges of the cope and drag where they meet.

Most home setups use greensand to cast in. This can be ordered or easily made without much expense by mixing sand and bentonite. An 11 to 1 mix of sand and bentonite, respectively, (or approximately 8% bentonite) is suggested.



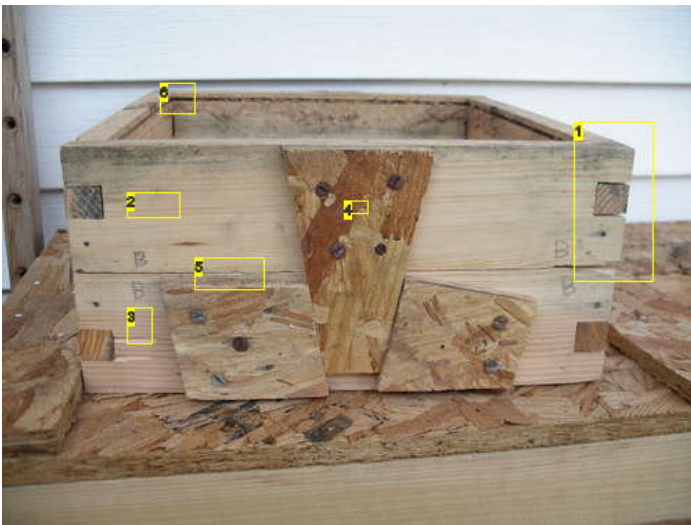
**Image Notes**

1. waferboard. You can usually pick up scraps from any construction site.



**Image Notes**

1. a handy place to store your flask  
 2. boards for casting  
 3. it's a good idea to line your box with a plastic bag or vinyl sheeting to avoid moisture loss, or gain.



**Image Notes**

1. simple box joints reinforced with nails  
 2. cope or top  
 3. drag or bottom  
 4. alignment pin  
 5. make sure these peices don't overlap the joint  
 6. this was an unfinished project. I just cut it in half on a table saw.

**step 4: Blacksmithing**

I don't have a proper anvil, they're expensive. But I do have a peice of railroad that works pretty ok with small projects and a couple large chunks of steel. One is bolted to my workbench and the other I attach to a stump when working outside.

For work other than casting I made a rectangular furnace, using sheetmetal to form it and then filling it with fire clay. Both ends are open, which makes heating specific parts of long peices easier.

I made some really ugly, but simple, tongs by riveting two peices of flat bar together then heating the end and twisting it.

I got a small sledge hammer because somebody threw it out when the handle broke. I just made a new one, free tools.

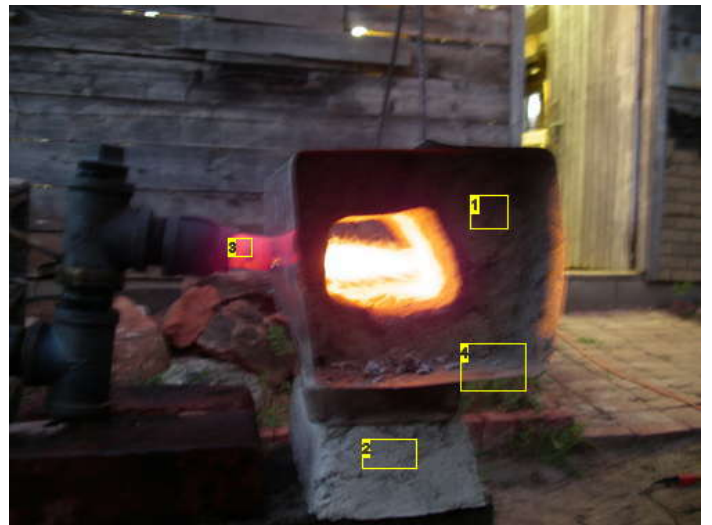
There were some big timbers on public land I found while out for a hike. They had been through a fire (conviently annealed) and I salvaged some of the steel fittings off of them.

When you're creative about materials things get cheaper.





**Image Notes**  
1. burned beam beside an abandoned road, go figure.



**Image Notes**  
1. the goofy rectangular furnace.  
2. fire brick molded in a breadpan  
3. you know it'll vaporize and burn the oil when this happens  
4. I ran out of fireclay so there's a few inches I need to cut off



**Image Notes**  
1. Ugly tongs  
<http://www.instructables.com/id/Waste-Oil-Forge-and-Foundry/>



- slag stick
- Sometimes if the burner is just not hot enough to vaporize the oil heating the oil line with a propane torch is just the push needed to get it going.

### step 5: Casting

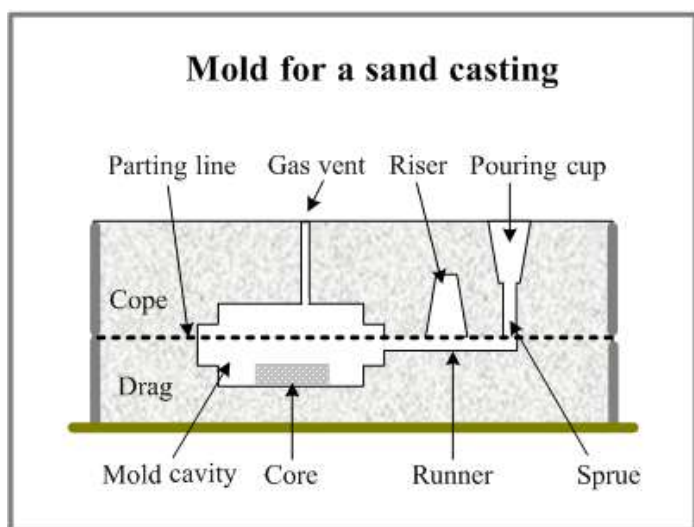
I'm still working on this. When I get a process down that works I'll post it.

here are the fundamentals..

How to set up the flask:

The sand should be moist enough to squeeze in your hand and retain it's shape, bounce it in your hand and it shouldn't crumble.

place the bottom (or drag) upside-down on one of the boards, put the item to be cast in the middle of the drag and fill it up with sand. Sift sand that will go immediatly around the pattern and don't worry so much about the rest. Use a rammer, or I've found that a small rubber mallet will work in a pinch, and pack sand tightly around the pattern. It takes a while to get a feel for how much pressure to use, but eventually you'll get the hang of it. Once the drag's compacted scrape off any sand that sicks up over the top edge. Place the other board on top of the drag and with both hands holding it securly flip it over. remove the top board and dust on parting powder. I've read that coal dust works great but it's a lot easier for me to get talcum powder (baby powder, talcum or corn starch can be used) Then put the cope (or top) in place. Pack sand onto the pattern just as you did for the drag. Then cut vent holes above the pattern by pushing a wire, anything from a coat hanger to a knitting needle will do, down through the sand until it touches the pattern. Next cut the sprue, or pouring hole, with a peice of thin brass or steel tubing about 3/4 of an inch in diameter. Now lift the cope off of the drag and set it on it's side, you'll know right here if you've done a good enough job ramming the sand. Once the two are seperated cut the gate, or runner, from the sprue to the patter. A simple tool to use is a spoon, making the channel about 3/4 of an inch wide and about 1/4 of an inch deep. Carefully lift the pattern out of the drag and then place the cope back into position. Pour the metal in a small stream and to one side of the sprue to let air escape and so it doesn't hit the bottom hard enough to loosen the sand. Give your casting time to cool off, then seperate the flask and take out your new part. Cut off the excess from the vent holes and sprue and stick them in a bucket for future use. Sand down your casting and you're good to go.



#### Image Notes

- during my first attempt at melting brass I accidentally melted the iron (I think) crucible too.

## Related Instructables



**Build a foundry and sand-cast aluminum.** by Fenris The bbw



**Waste Oil Furnace For Melting Metal** by rjeblogue



**Aluminum Foundry** by StaticPhocus



**How to make a mini forge out of an Altoids tin** by steampirate



**Quick and cheap aluminum melting furnace setup** by robtoberfest



**Press Aluminum Cans into Ceiling and Wall Tiles** by robtoberfest



**Driveway aluminum foundry (slideshow)** by Flashflint



**Coffee Can Aluminum Foundry** by 2k4u

# Comments

25 comments [Add Comment](#)



**sharlston** says:  
what oil did yoy use?

Sep 19, 2009. 12:01 PM [REPLY](#)



**notjustsomeone** says:  
the first couple runs were with oil I'd changed out of my truck, after that I just got some from a local recycling center. I'd suggest going to an auto shop though, the recycling center dumped all sorts of stuff into their waste oil tank.

Sep 20, 2009. 10:31 AM [REPLY](#)



**sharlston** says:  
is unused oil better ?

Sep 20, 2009. 11:25 AM [REPLY](#)



**notjustsomeone** says:  
infinitely better, it burns hotter and cleaner. The idea of a waste-oil burner is that it uses something that otherwise would be waste and costs virtually nothing to operate. If you don't mind paying for all of your fuel though, I'd suggest propane.

Sep 24, 2009. 8:42 PM [REPLY](#)



**dpsilver** says:  
its best to use vegetable oil over motor oil because motor oil burns to give off toxic chemicals and this can be absorbed by your metal and change its composition and properties and not to mention the health risks

Nov 14, 2009. 5:09 PM [REPLY](#)



**zascecs** says:  
You'll give away Will Smith for *food*???

May 29, 2009. 2:22 PM [REPLY](#)



**M4industries** says:  
mmmmm!

Aug 7, 2009. 4:24 PM [REPLY](#)



**dsman195276** says:  
that picture made me think of "will smith" the actor lol.

Jul 25, 2008. 6:53 AM [REPLY](#)



**M4industries** says:  
I think that's the pun inside the pun!

Aug 7, 2009. 4:24 PM [REPLY](#)



**Artekus** says:  
Wow props for doing this instead of just researching it like me :)

Jul 31, 2009. 11:40 AM [REPLY](#)

Take a look at <http://www.backyardmetalcasting.com> . The guy there did several iterations of burner and ended up with a single horizontal tube for efficiency. It's also just a great site :D

I was wondering, do you find that the heat is too high to forge with? I'd have thought you would start to burn out the carbon, yet you seem to be doing fine.



**spudster** says:  
nice, its simple and looks effective

Feb 17, 2009. 11:42 AM [REPLY](#)



**Mig Welder** says:  
Harbor Freight: 55 lb. anvil \$50

Dec 23, 2008. 1:15 PM [REPLY](#)



**Hoopajoo** says:  
Harbor Freight ones are cast. Cast anvils= CRAP! Railroad track and/or an I-beam section are MUCHO better.

Feb 4, 2009. 4:42 PM [REPLY](#)





**blair.jj** says:  
Stay away from the harbor freight anvil, the railroad track piece is better

Jan 31, 2009. 7:06 AM [REPLY](#)



**jtobako** says:  
You have to watch the quality at Harbor Freight-some are so soft that the slightest strike will dent them. Some are cast iron instead of cast steel, which makes them too brittle to do any heavy work on (chipping and other cracks).

Jan 30, 2009. 7:36 PM [REPLY](#)



**panstar1** says:  
oh I forgot to say is waste oil furnace's are now against the law to use or around were I live ( I am a hvac tech )

Oct 9, 2008. 9:16 PM [REPLY](#)



**The Red Button** says:  
why?

Jan 6, 2009. 5:46 PM [REPLY](#)



**Mig Welder** says:  
what iron did you melt?

Dec 20, 2008. 6:46 AM [REPLY](#)



**notjustsomeone** says:  
The first time can be seen in the last step of the instructable and was a plumbing end-cap. The second time another make-shift crucible was purported to be steel, it wasn't. The second event was a bit more destructive, but was stopped in time to avoid "casting" a new bottom to the furnace.

Dec 22, 2008. 7:50 PM [REPLY](#)



**panstar1** says:  
you could use a oil burner from an old furnace ,they are some what easy to find and they have an automatic starter built in plus some have a electronic control to take care of starting just wire a simple switch across the r terminal & w terminal and just wire a power cord  
I would like to add some burners use a weird controller and drive the blower motor at 55 volt with a pmw , they are just built complicated for nothing the standard just use a 120 volt motor and a 120 VAC ignition transformer and a simple control box for starting the only problem would be making sure the cad cell can see the flame or else it will never start .

Oct 9, 2008. 9:12 PM [REPLY](#)



**2k4u** says:  
AWESOME. Instructables has been needing a good, in-depth WVO/WMO tutorial. There's one other one, but it's kinda vague. Nice job, and thanks a bunch for giving a link to mine. I'm making propane reil type burner + new furnace, then I'll be on to waste oil eventually. Keep up the good work.

Aug 17, 2008. 6:39 PM [REPLY](#)



**Ferrite** says:  
Nice!

Aug 14, 2008. 7:11 PM [REPLY](#)



**Jawatech** says:  
GREAT JOB! I'd love to build one of these. Its a great way to make use of used engine oil.

Jul 26, 2008. 12:04 PM [REPLY](#)



**mieszalniapasz** says:  
GJ!  
Take look on mine 44 kW automatic, homemade waste oil burner. Maybe you'll find some solution.  
Regards!

Jul 25, 2008. 1:03 PM [REPLY](#)



**rimar2000** says:  
Spectacular! I envy you ;)

Jul 25, 2008. 9:10 AM [REPLY](#)